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Electron Microscope Study on the Infectious Hepatitis (Second Quarterly Report)

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The present observations were made during studies of biopsy materials of liver in cases of infectious hepatitis in order to look for virus-like particles and also to learn about characteristics of the liver cell that might have bearing on susceptibility or resistance to infection.

Material and Methods

The material was obtained by biopsy from a 32-year-old man with acute infectious hepatitis. The liver biopsy specimen was cut into tiny blocks (1 mm. in greatest dimension). They were fixed for 30 minutes at 4°C. in 1 per cent osmium tetroxide adjusted with veronal-acetate buffer at pH 7.4. After fixation the specimen was directly, without washing in distilled water, dehydrated in a series of increasing concentrations of ethyl alcohol, and embedded in a mixture of methyl and *n*-butyl methacrylates or araldite epoxy resin 812. Sections were cut on a Porter-Blum's microtome with glass knives; sections were mounted on copper grids coated with formvar. They were stained according to a slight modification of Watson's lead acetate procedure, and a thin coat of carbon evaporated onto them. They were examined in an Akashi-TRS-50E, electron microscope, or a JEM-6A electron microscope.

Results

In hepatic parenchymal cells in a case of acute infectious hepatitis, all the mitochondria are characteristically filled with the roughly homogeneous matrix which is enveloped by a double-layed limiting membrane (Figs. 1-4). Mitochondria are sometimes enveloped with a row of dense granules (Fig. 2). Cristae mitochondriales are found in a small amount in between the matrix (Figs. 1-4).

Although numerous, circular, elongated or irregularly shaped profiles of the rough-surfaced endoplasmic reticulum are found, no glycogen granules are visible in the parenchymal cells (Figs. 1-4). The RNP granules appear attached to outer surfaces of vesicles (Figs. 1, 3 and 4) and isolated in the cytoplasmic matrix, often in a rosette form (Fig. 1 and 3).

The Golgi vesicles are remarkably enlarged and contain a ring-like body constructed of fine vesicles, and amorphous materials (Fig. 4). The Golgi lamellar structure is scacely visible.

In addition to mitochondria, endoplasmic reticulum and Golgi vesicles, the cytoplasm contains round bodies or irregularly shaped, vesicular bodies with dense particles about 60 A in diameter in clusters (Figs. 3 and 4). It is assumed that these bodies represent terminal appearance of phagocytic vacuoles and that the dense granular material they contain is a metal-organic compound, ferritin molecules.

It must be noticed that the cytoplasm contains dense particles about 180 A in diameter in clusters in vesicles appearing in the parenchymal cells (Figs. 3 and 4). These particles are characteristic in size,

that is to say, they are larger than RNP granules and ferritin molecules, and smaller than glycogen granules (about 450 A in diameter).

It is evident from an electron micrograph (Fig. 2) that the nucleus is surrounded by a membrane composed in part of pores having a diameter of approximately 200 A. It is clearly visible that the nuclear envelope is constructed of double layers. Of special interest is the extension of the granular nuclear material into the cytoplasm through pores of the nuclear envelope. That is, the granular material of the nucleus is continuous with that of the adjoining cytoplasm through pores of the nuclear envelope. Aggregated at certain positions adjacent to the nuclear envelope within the cytoplasm are irregularly shaped masses of granules. Certain of these masses within the cytoplasm are seen to be continuous one another. Thus, it is assumed that dense bodies and irregularly shaped granular bodies within the cytoplasm have been originated from the nucleus.

Summary

During the course of electron microscope study of biopsy materials of human liver in cases of infectious hepatitis, it was found that dense particles 180 A in diameter appeared in vesicles within the cytoplasm of parenchymal cells. In addition to these dense particles, two kinds of peculiar bodies have appeared in the cytoplasm of parenchymal cells: One of which is assumed to be a phagocytic body containing ferritin molecules; the other is an irregularly shaped body originated from the nucleus. Glycogen granules have never been observed in the cytoplasm of parenchymal cells examined.

(August 15, 1962)

Fig. 1. Electron micrograph of parenchymal cell of the liver in a cases of infectious hepatitis, showing numerous mitochondria (**M**), enlarged granular vesicules (**V**) and RNP granules in a rosette form (arrows).

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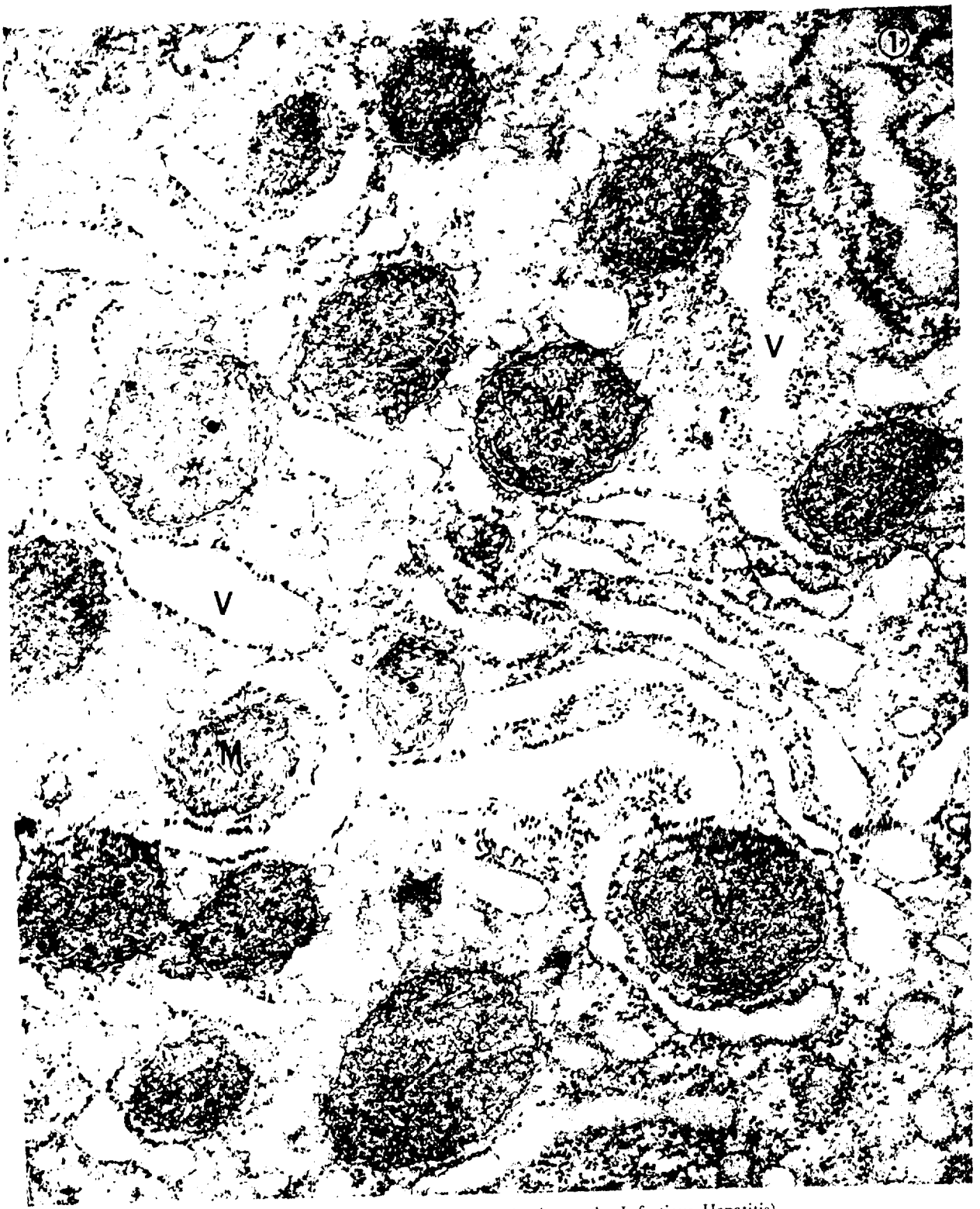
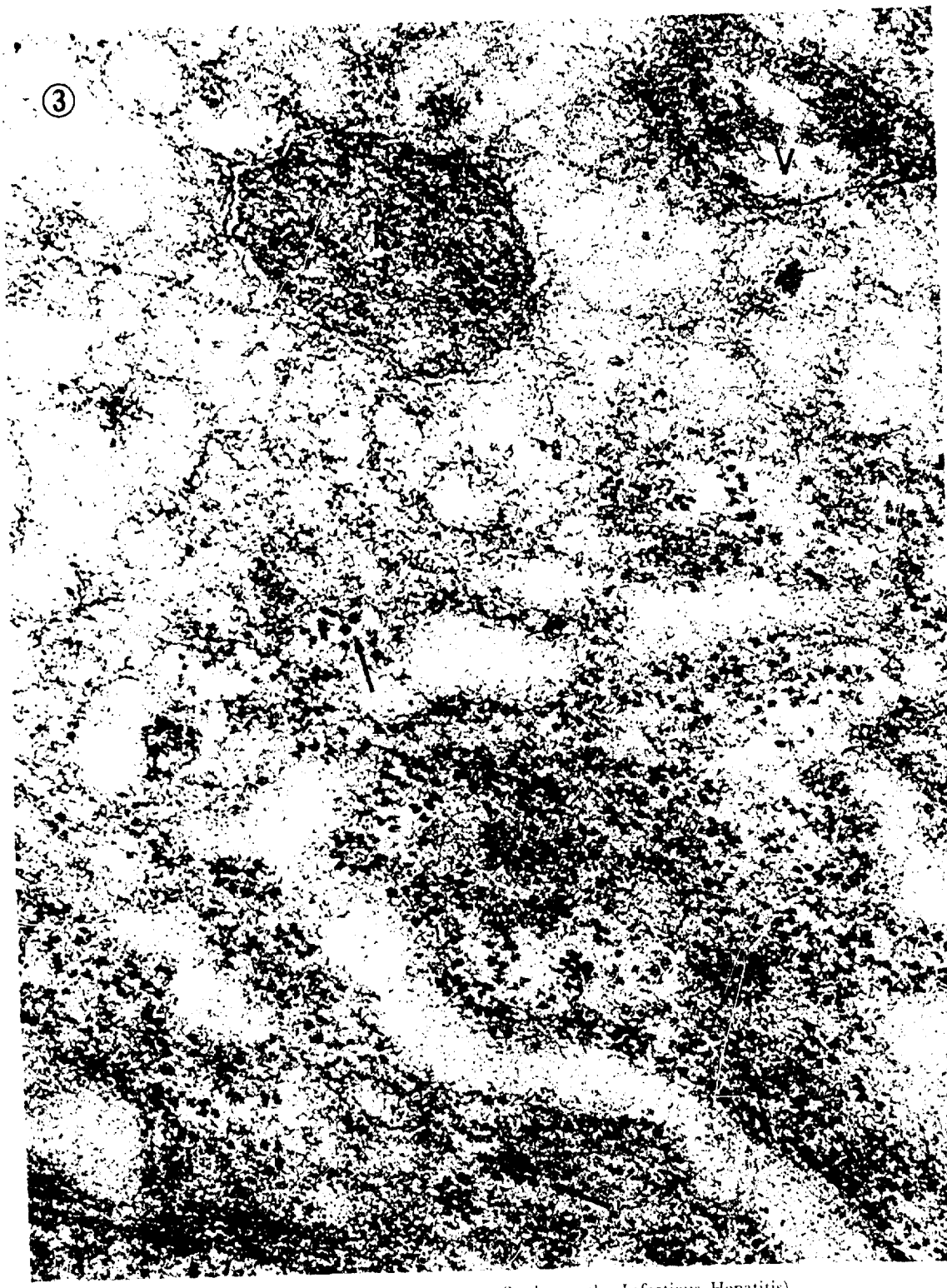


(G. Yasuzumi : Electron Microscope Study on the Infectious Hepatitis)

Fig. 2. Electron micrograph of a parenchymal cell showing the granular nucleolus (**NC**), grosser granular karyoplasma (**KP**), nuclear pores (**NP**), and substances aggregated adjacent to the nuclear envelope some of which are in contact with the pores of the envelope and continuous with amorphous substances or granular substances within the cytoplasm. The cytoplasm contains mitochondria (**M**) and dense bodies (**DB**), but it is devoid of almost rough-surfaced endoplasmic reticulum. ×46,000.

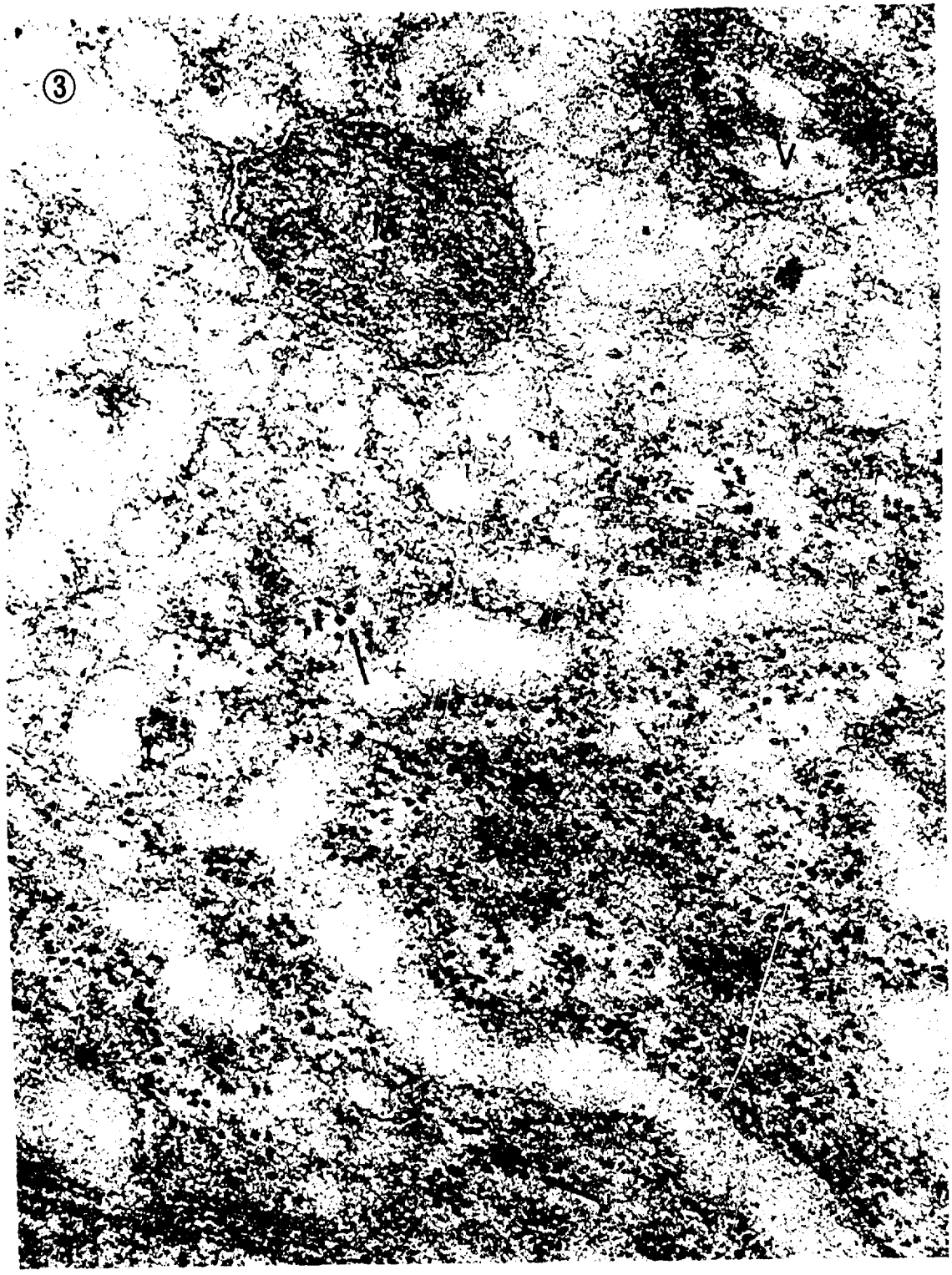
(G. Yasuzumi : Electron Microscope Study on the Infectious Hepatitis)

Fig. 3. Electron micrograph of a hepatic parenchymal cell in a case of acute infectious hepatitis. A mitochondrion (**M**) with the roughly homogeneous matrix is enveloped by the double-layered limiting membrane. A vesicle (**V**), which is almost limited by an apparently single-layered membrane, contains dense particles about 60 A in diameter and an amorphous substance of intermediate density. The upper half side of the figure is occupied by numerous profiles of the endoplasmic reticulum which belongs predominantly to the smooth-surfaced variety. The lower half side is occupied by the rough-surfaced vesicles and RNP-granules about 130 A in diameter in a rosette form. Note the presence of groups of dense particles 180 A in diameter (arrows) in vesicles. ×93,000.



(G. Yasuzumi : Electron Microscope Study on the Infectious Hepatitis)

Fig. 4. Electron micrograph of a part of parenchymal cell of the liver in a case of acute infectious hepatitis. Enlarged Golgi vesicles (**GV**) contain a few amorphous materials. A peculiar body (**PB**) limited by an incompletely double-layered membrane consists of a globoid dense body, a cluster of dense particles 60 A in diameter, and fibrillar materials. A mitochondrion (**M**) with a dense matrix and a few cristae is enveloped by a double-layered membrane. The cytoplasm is occupied by numerous profiles of granular vesicles. A cluster of dense particles (arrow) about 180 A in diameter can be seen in vesicles. ×93,000.



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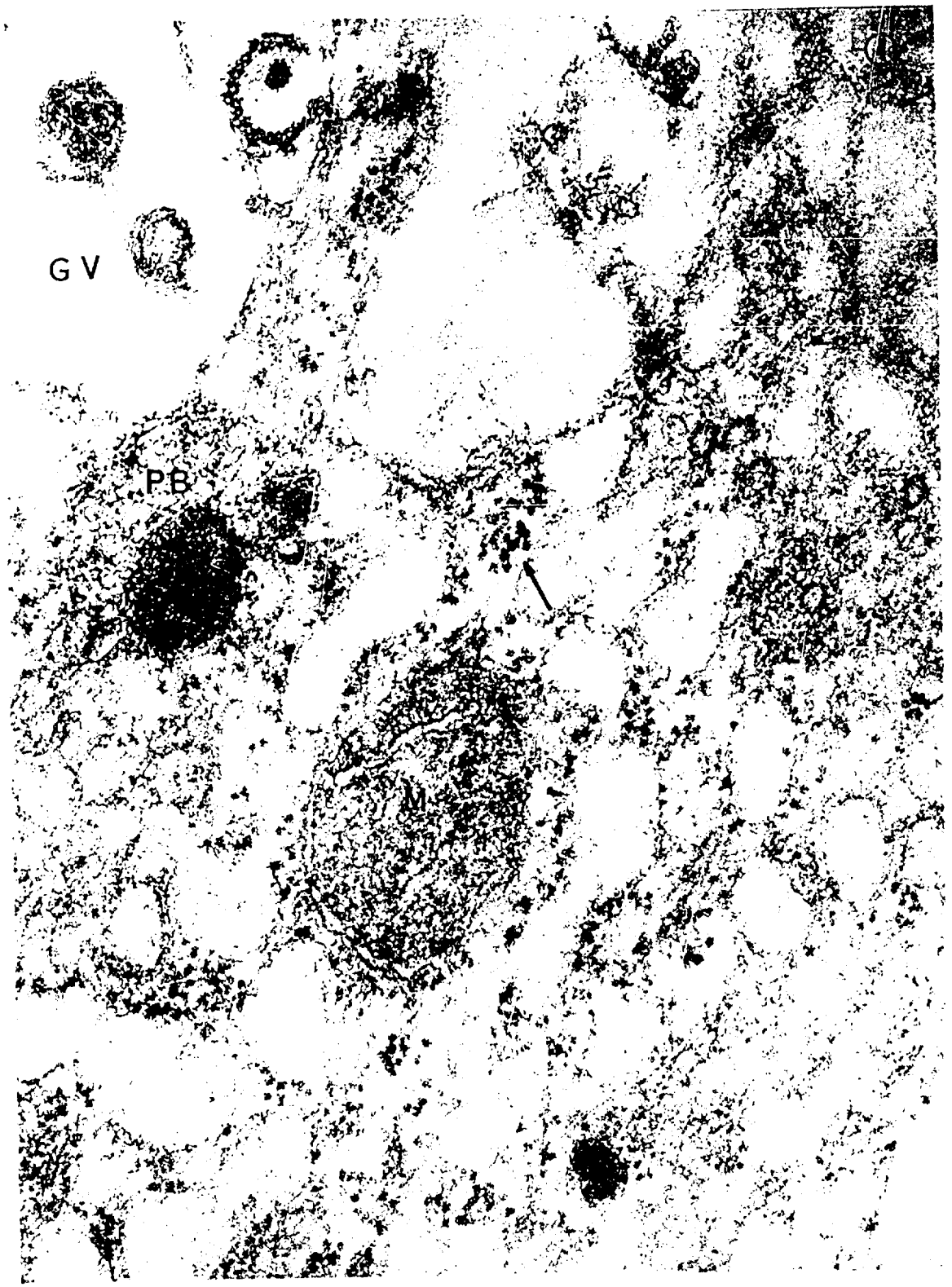

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